

Notice of Allowability

Application No.

10/630,525

Examiner

Srirama Channavajjala

Applicant(s)

ANDREASSON, EVA

Art Unit

2166

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 7/10/06.
2. ☒ The allowed claim(s) is/are 7-10,12,14-16 and 18-29[re-numbered as: 1-20].
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 9/13/2006.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

1. Examiner acknowledges applicant's amendment filed on 7/10/2006.
2. Claims 1-6,11,13,17 have been cancelled [7/10/2006].
3. Claims 7,12 have been amended [7/10/2006].
4. Claims 18-29 have been added [7/10/2006].

Drawings

5. The Drawings filed on 7/30/2003 are acceptable for examination purpose.

Priority

6. Applicant's claim for domestic priority under 35 U.S.C. 119(e) is acknowledged based on the provisional application **60/400,143** filed on 7/31/2002; **60/400,213**, filed on 7/31/2002..

Information Disclosure Statement

7. The information disclosure statement filed on 11/28/2003 is in compliance with the provisions of 37 CFR 1.97, and has been considered and a copy is enclosed with previous Office Action mailed on 2/10/2006.

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Interview:

8. Applicant's Attorney Karl Kenna, Regd.No. 45,445 is thanked for the telephone interview on 13 September 2006. During that telephone interview Karl Kenna granted authorization to **amend claims 7,10,12,16,18-22,24-28.**

EXAMINER'S AMENDMENT

9. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Karl Kenna, Regd.No. 45,445 on 13 September 2006.

The application has been amended as follows:

In the Claims: Claims 7, 10, 12, 16, 18-22 and 24-28, all as shown below.

1-6. (Canceled).

7. (Currently Amended) A system for memory management comprising:
a computer system including a virtual machine operating thereon;
a memory space within said computer system and accessible by the virtual machine for the runtime storage and execution of applications; and,

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a garbage collector that uses a reinforcement learning process to control the allocation of memory to applications within the memory space;

wherein the garbage collector performs the steps of

(a) measuring system-wide and application-specific parameters, and system events, to determine a current state of the memory space, including the degree of fragmentation in the memory space,

(b) performing an action to adjust the allocation of memory in the memory space, including garbage collecting the memory space,

(c) calculating a reward value that indicates the success of the action on the memory space, including adding or subtracting preset values for specified actions of the garbage collector or conditions of the memory space,

(d) storing information about the state, action and reward value for subsequent use by the garbage collector,

(e) subsequently measuring the system-wide and application-specific parameters, and system events, to determine a new state of the memory space,

~~monitoring system events that contribute to the state,~~

(f) retrieving and using the stored information about the state, action and reward value to determine an optimal action that the garbage collector should perform on the memory space to maximize a likely future reward value,

(g) performing actions by the determined action by the garbage collector to adjust the allocation of memory,

(h) calculating a new reward value that indicates the success of the determined action on the memory space, ~~and measuring the system-wide and application-specific parameters to determine a new state associated with the reward,~~
and,

(i) repeating ~~the~~ steps (d) through (h) ~~as necessary~~ to control the allocation of memory to applications within the memory space.

8. (Original) The system of claim 7 wherein the virtual machine is a Java Virtual Machine.

9. (Original) The system of claim 7 wherein the reinforcement learning uses a temporal difference method.

10. (Currently Amended) The system of claim 9 wherein the temporal difference method uses an on-policy on-line SARSA algorithm that uses the information about the state, action and reward value to first determine an optimal action that the garbage collector should perform, and then updates the information about the new state, action and reward value, for subsequent use in determining additional actions.

11. (Canceled).

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12. (Currently Amended) A method for memory management comprising the steps of:

analyzing the memory space of a computer system or virtual machine; and,

using a garbage collector together with a reinforcement learning process to control the allocation of memory to applications within the memory space

wherein the garbage collector performs the steps of

(a) measuring system-wide and application-specific parameters, and system events, to determine a current state of the memory space, including the degree of fragmentation in the memory space,

(b) performing an action to adjust the allocation of memory in the memory space, including garbage collecting the memory space,

(c) calculating a reward value that indicates the success of the action on the memory space, including adding or subtracting preset values for specified actions of the garbage collector or conditions of the memory space,

(d) storing information about the state, action and reward value for subsequent use by the garbage collector,

(e) subsequently measuring the system-wide and application-specific parameters, and system events, to determine a new state of the memory space,

~~monitoring system events that contribute to the state,~~

(f) retrieving and using the stored information about the state, action and reward value to determine an optimal action that the garbage collector should perform on the memory space to maximize a likely future reward value,

(g) performing ~~actions by~~ the determined action by the garbage collector to adjust the allocation of memory,

(h) calculating a new reward value that indicates the success of the determined action on the memory space, and ~~measuring the system-wide and application-specific parameters to determine a new state associated with the reward~~, and,

(i) repeating ~~the steps~~ (d) through (h) ~~as necessary~~ to control the allocation of memory to applications within the memory space.

13. (Canceled).

14. (Original) The method of claim 12 wherein the virtual machine is a Java Virtual Machine.

15. (Original) The method of claim 12 wherein the reinforcement learning uses a temporal difference method.

16. (Currently Amended) The method of claim 15 wherein the temporal difference method uses an on-policy on-line SARSA algorithm that uses the information about the state, action and reward value to first determine an optimal action that the garbage collector should perform, and then updates the information about the new state, action and reward value, for subsequent use in determining additional actions.

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17. (Canceled).

18. (Currently Amended) The system of claim 7, wherein the system-wide and application-specific parameters used to determine a the current state include the amount of memory allocated ~~memory per~~ by the system within a particular time unit.

19. (Currently Amended) The system of claim 7, wherein the system-wide and application-specific parameters used to determine a current state include the amount of allocated memory the last time a decision to garbage collect was made.

20. (Currently Amended) The system of claim 7, wherein the system-wide and application-specific parameters used to determine a current state include how much of the memory space is fragmented.

21. (Currently Amended) The system of claim 7, wherein the system-wide and application-specific parameters used to determine a current state include any of the average size of new allocated objects, average age of allocated objects, or average amount of new allocated objects.

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22. (Currently Amended) The system of claim 7, wherein the system events that contribute to the current state and for which preset reward values are associated include any of ~~a variable representing if~~ whether a garbage collection was made during the last time step, ~~a variable representing if~~ whether the system ran out of memory during the last time step, the amount of occupied memory before the garbage collection, the amount of occupied memory left after completed garbage collection, or ~~the number of situations where a heap lock needed to be taken~~ whether the garbage collector made a heap lock during the last time step.

23. (Previously Presented) The system of claim 7, wherein the actions by the garbage collector to adjust the allocation of memory include whether to garbage collect or not, whether to extend or compact the memory space, and by how much.

24. (Currently Amended) The method of claim 12, wherein the system-wide and application-specific parameters used to determine a the current state include the amount of memory allocated memory per by the system within a particular time unit.

25. (Currently Amended) The method of claim 12, wherein the system-wide and application-specific parameters used to determine a current state include the amount of allocated memory the last time a decision to garbage collect was made.

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26. (Currently Amended) The method of claim 12, wherein the system-wide and application-specific parameters to used determine a current state include how much of the memory space is fragmented.

27. (Currently Amended) The method of claim 12, wherein the system-wide and application-specific parameters used to determine a current state include any of the average size of new allocated objects, average age of allocated objects, or average amount of new allocated objects.

28. (Currently Amended) The method of claim 12, wherein the system events that contribute to the current state and for which preset reward values are associated include any of ~~a variable representing if~~ whether a garbage collection was made during the last time step, ~~a variable representing if~~ whether the system ran out of memory during the last time step, the amount of occupied memory before the garbage collection, the amount of occupied memory left after completed garbage collection, or ~~the number of situations where a heap lock needed to be taken~~ whether the garbage collector made a heap lock during the last time step.

29. (Previously Presented) The method of claim 12, wherein the actions by the garbage collector to adjust the allocation of memory include whether to garbage collect or not, whether to extend or compact the memory space, and by how much.

In the Title:

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Pursuant to MPEP 606.01 the **Title** is changed to read:

**--- SYSTEM AND METHOD FOR GARBAGE COLLECTION USES REINFORCEMENT
LEARNING PROCESS TO PERFORM ADJUST THE ALLOCATION OF MEMORY
SPACE, CALCULATING REWARD VALUE THAT INDICATES SUCCESS OF THE
ACTION ON THE MEMORY SPACE AND MEASURING APPLICATION SPECIFIC
PARAMTERS, SYSTEM EVENTS TO DETERMINE NEW STATE OF THE MEMORY
SPACE --**

Reasons for allowance

Claims 7-10,12,14-16,18-29 are allowed

The following is an examiner's statement of reasons for indication of allowable subject matter: The prior art of record does not disclose, make obvious, or otherwise suggest the structure of the applicant's memory management "(c) *calculating a reward value that indicates the success of the action on the memory space, including adding or subtracting preset values for specified actions of the garbage collector or conditions of the memory space,*

(d) storing information about the state, action and reward value for subsequent use by the garbage collector,

(f) retrieving and using the stored information about the state, action and reward value to determine an optimal action that the garbage collector should perform on the memory space to maximize a likely future reward value,

(h) calculating a new reward value that indicates the success of the determined action on the memory space" in claim 7,12.

These features, together with the other limitations of the independent claims are novel and non-obvious over the prior art of record. The dependent claims 8-10, 14-16,18-29 being definite, enabled by the specification, and further limiting to the independent claims are also allowable.

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Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance".

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alam, Hosain, T, can be reached on (571) 272-3978. The fax phone numbers for the organization where the application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free)

sc

Patent Examiner.

September 13, 2006.


SRIRAMA CHANNAVAJALA
PRIMARY EXAMINER